

PBLE01
Co-design de produtos eletrônicos

Manual

Rev 01 - Dez/2024

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Identificação

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Data: 03/12/2024

1 Introdução

1.1 Escopo

Este documento tem como principal objetivo apresentar e documentar a placa de circuito impresso, PCI, para a disciplina PBLE01 - Co-design de produtos eletrônicos. Durante o decorrer do arquivo serão explicadas as principais características da placa, bem como as funcionalidades e componentes presentes na mesma.

1.2 Visão geral

Durante a confecção da placa, o desenvolvimento como um todo foi separado em módulos, chamados de subcircuitos, sendo eles: subcircuito de alimentação, subcircuito de operação, subcircuito de interação, subcircuito de periféricos e subcircuito de expansão. Para cada subcircuito, foram considerados pontos específicos de acordo com os requisitos propostos.

Além disso, a placa em sua versão final pode ser vista a partir das figuras 1 e 2.

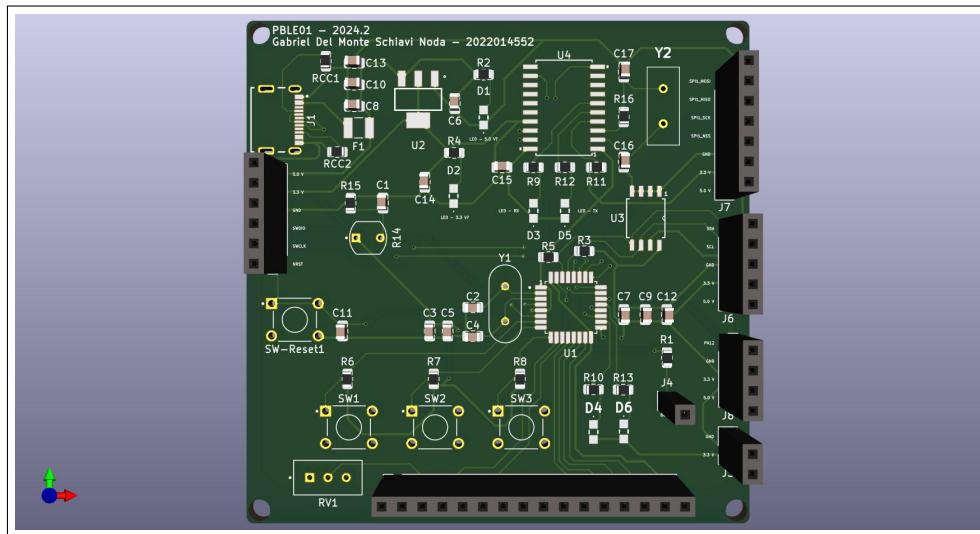


Figura 1: Visão superior da placa 3D

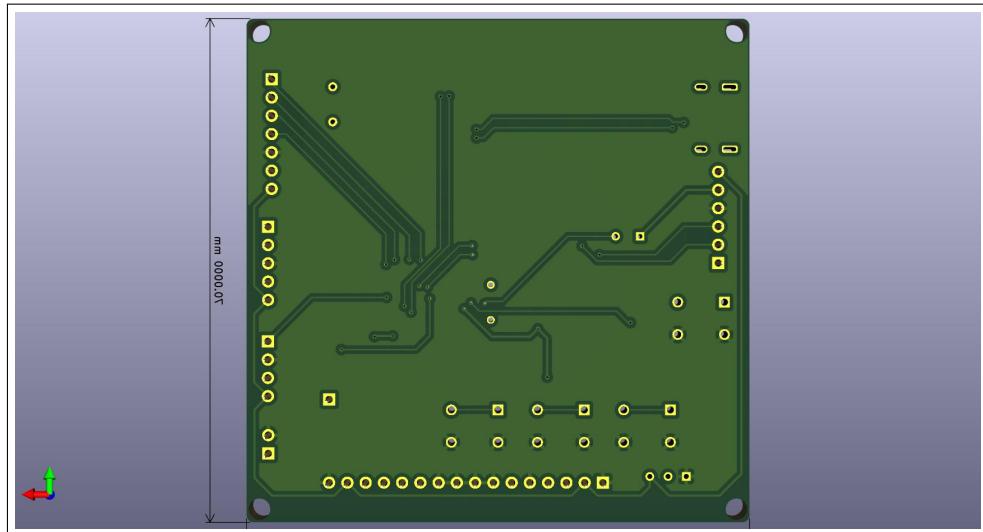


Figura 2: Visão inferior da placa 3D

2 Projeto

Nesta seção, serão discorridos os principais aspectos do esquema elétrico desenvolvido para o projeto final. O desenvolvimento do esquema elétrico foi feito de forma a atender os requisitos propostos, sendo dividido em subcircuitos, cada um com suas respectivas funções. Além disso, também serão apresentados o relatório de erros e o mapa de pinos do microcontrolador utilizado.

2.1 Dimensões

O dimensionamento da placa foi feito de forma a atender o espaço e requisitos necessários para a montagem de todos os subcircuitos propostos. Deste modo, a placa possui dimensões de 70 mm x 70 mm, conforme pode ser visto na figura 3.

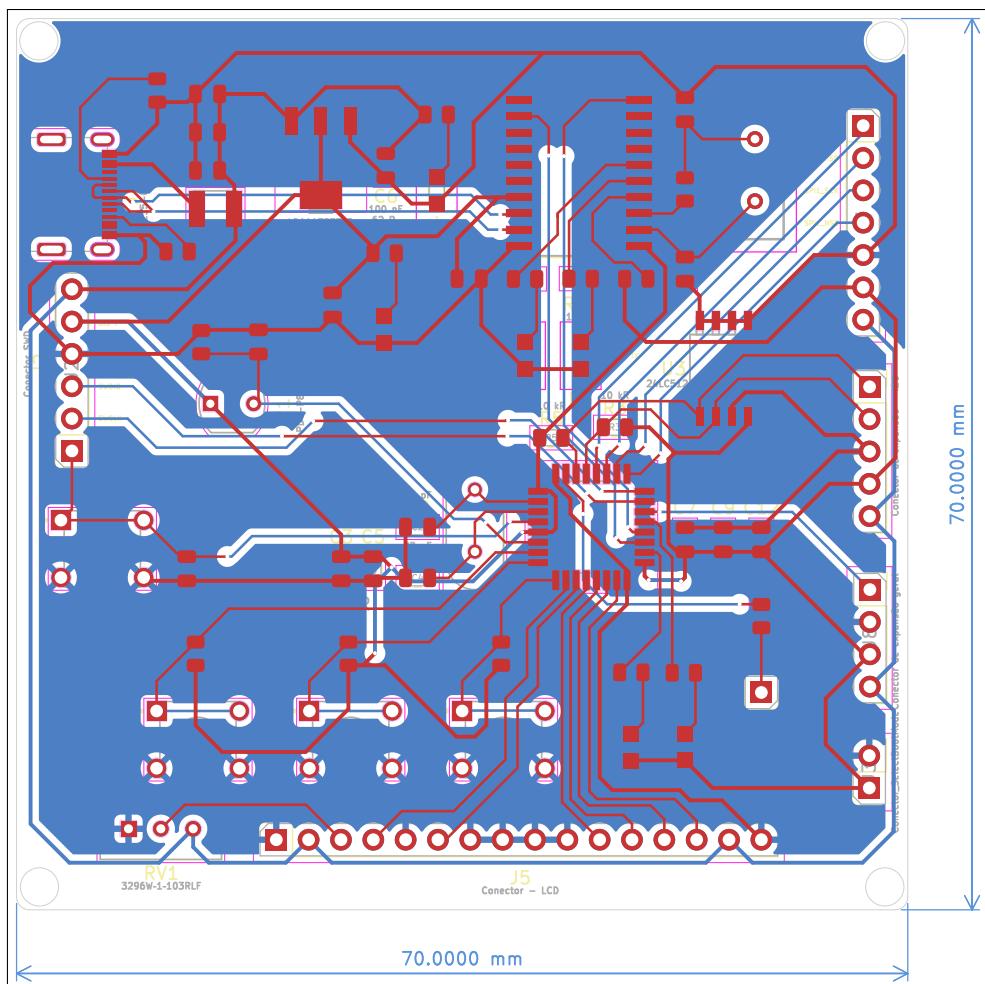


Figura 3: Dimensionamento da PCI

2.2 Subcircuitos

Nesta subseção serão apresentados os subcircuitos desenvolvidos durante o projeto.

2.2.1 Subcircuito de alimentação

O subcircuito de alimentação possui como principais componentes o receptor USB-C, USB4215-03-A_REV_A, e o regulador de tensão, LD1117S33TR, que fornecem a alimentação necessária para o funcionamento da placa. Além disso, foram dispostos LED's para a sinalização de tensão de 5.0 [V] e 3.3 [V], conforme pode ser visto na figura 4.

Vale ressaltar que o circuito projeto foi baseado na montagem recomendada pelo fabricante do regulador de tensão, de forma a ser visto em seu datasheet completo, representado neste documento pela folha de rosto na figura 27.

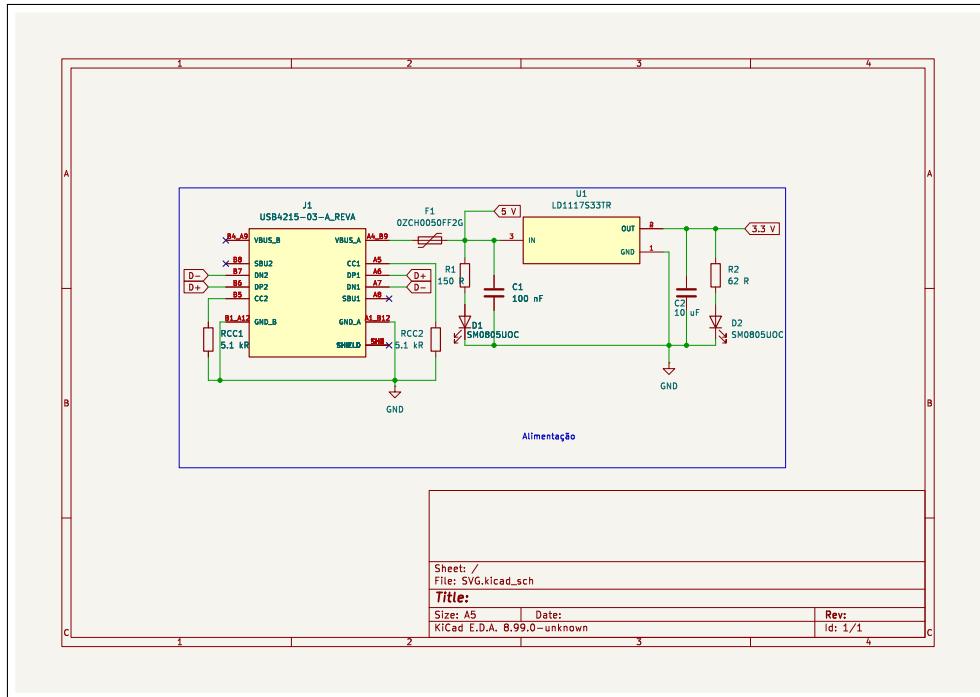


Figura 4: Subcircuito de alimentação

2.2.2 Subcircuito de operação

O subcircuito de operação possui como principal componente o microcontrolador utilizado durante o projeto, o STM32F030K6T6TR. Além disso, neste subcircuito também estão presentes capacitores e resistores, o cristal de operação do microcontrolador e o conector para a seleção de BOOT. A figura 5 apresenta o esquemático do subcircuito de operação de forma completa.

Para a alimentação do circuito de operação, representado pelas conexões com os pinos do tipo V_{DD} , foi utilizada a montagem recomendada pelo fabricante, demonstrada pelo datasheet da figura 35. Além disso, para determinar o modo de seleção de BOOT do microcontrolador, foi proposta a utilização de conectores entre o pino BOOT0 do microcontrolador e o sinal do tipo V_{DD} ou GND. Por fim, vale ressaltar que é de extrema importância se atentar para não realizar a conexão do conector USB juntamente com o conector SWD, tendo em vista que a utilização destes dois conectores em conjunto pode ocasionar danos ao sistema como um todo.

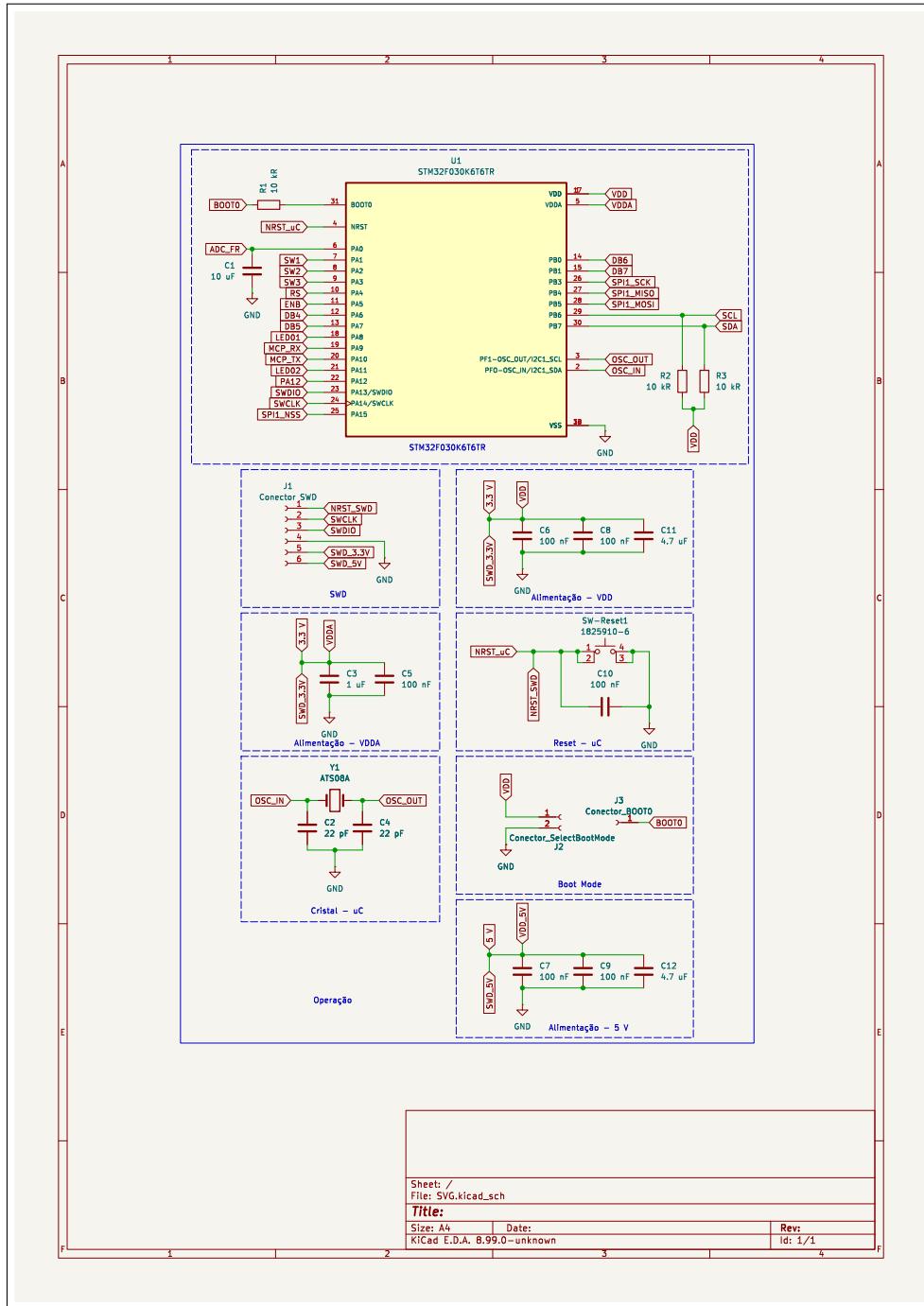


Figura 5: Subcircuito de operação

2.2.3 Subcircuito de interação

O subcírculo de interação com o usuário apresenta outros subcircuitos, sendo eles: subcírculo de comunicação com o display LCD, subcírculo de comunicação com um teclado de 3 teclas e subcírculo de interação via LEDs. Todos estes circuitos podem ser visto na figura 6, sendo que estão separados de acordo com suas funções.

Conforme a tensão de saída do microcontrolador, o uso do LCD se restringe para aqueles que suportam e/ou entendem os níveis lógicos do circuito total, sendo assim, para a aplicação projetada, deve-se utilizar o LCD referenciado pela figura 36.

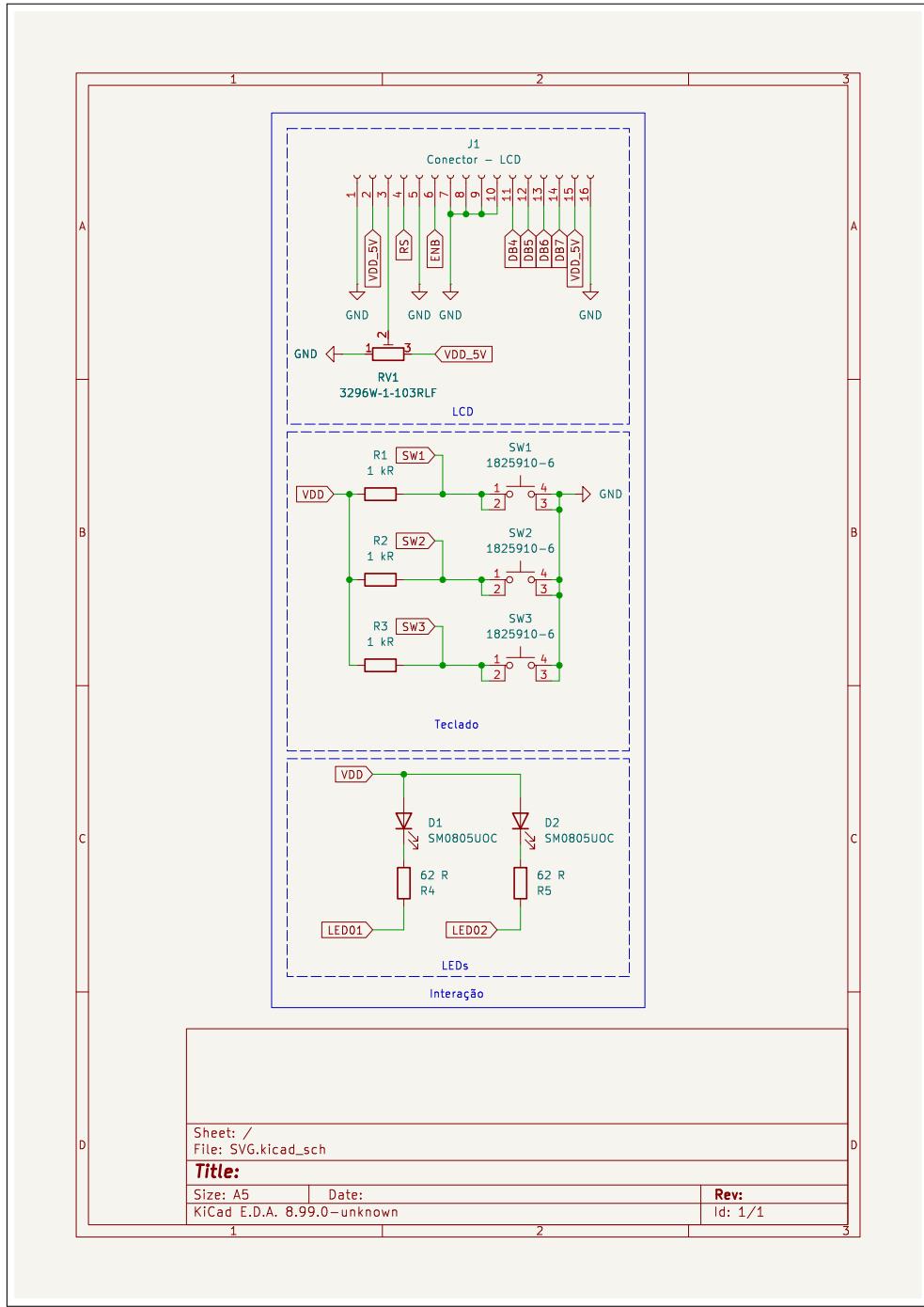


Figura 6: Subcircuito de interação

2.2.4 Subcircuito de periféricos

O subcircuito de periféricos possui como principais componentes o transceptor USB-Serial, MCP2200-I-SO, a memória EEPROM, 24LC512, e um fotorresistor, PDV-P8103. Todos estes componentes podem ser vistos na figura 7.

Para a montagem dos subcircuitos de periféricos, foram consideradas todas as montagens propostas pelos fabricantes, de acordo com os datasheets referenciados pela figuras 17, 28 e 29.

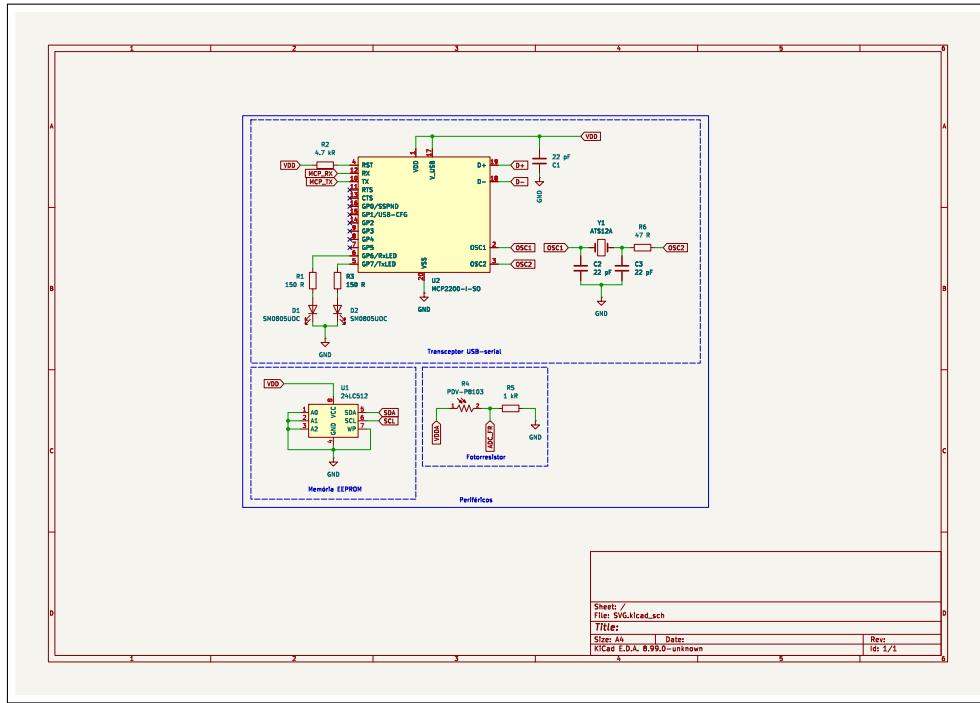


Figura 7: Subcircuito de periféricos

2.2.5 Subcircuito de expansão

O subcírcuito de expansão possui os conectores externos para a comunicação SPI, I2C e além disso também dispõe conectores para os pinos não utilizados no microcontrolador. A figura 8 apresenta o esquemático do subcírcuito de expansão.

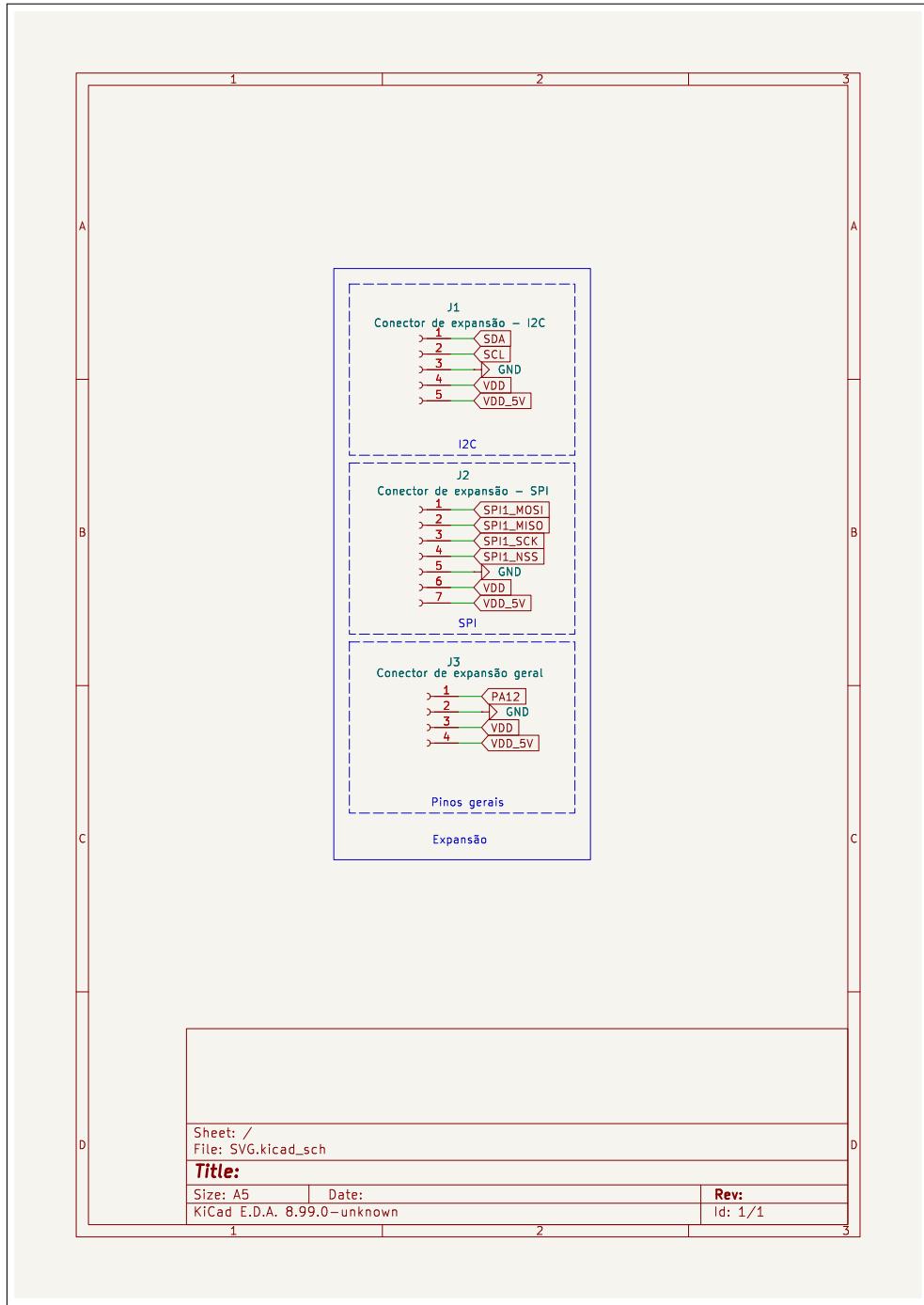


Figura 8: Subcircuito de expansão

2.2.6 Esquema elétrico

O esquema elétrico do circuito total pode ser visto a partir da figura 9.

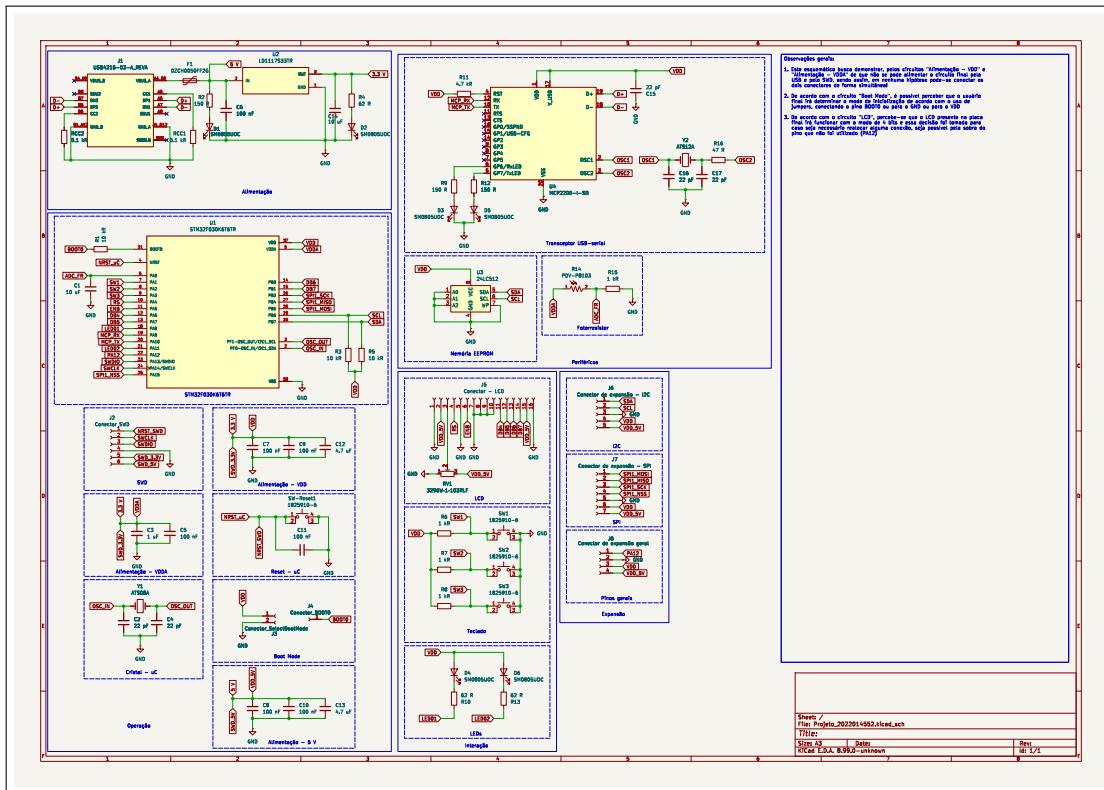


Figura 9: Esquema elétrico completo

2.3 Relatório de erros

A partir da figura 10 é possível verificar o relatório de erros de projeto realizado pelo software Kicad.

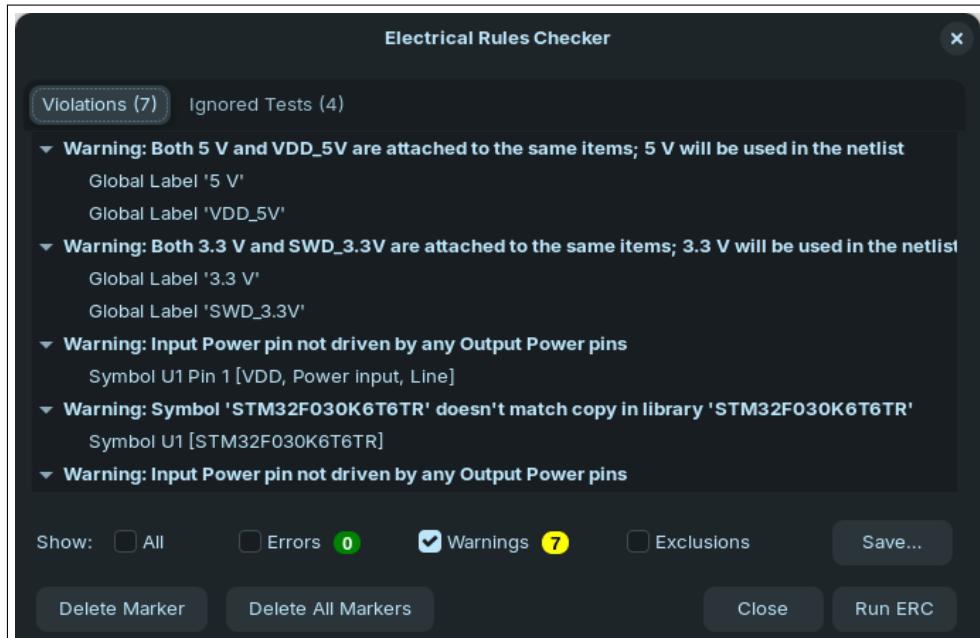


Figura 10: Relatório de erros para o esquema elétrico - Kicad

2.4 Mapa de pinos

2.4.1 Microcontrolador

Nesta subseção será apresentado o mapa de pinos do microcontrolador STM32F030K6T6TR, utilizado no projeto de acordo com a tabela 1.

Tabela 1: Mapa de pinos do microcontrolador STM32F030K6T6TR

Microcontrolador	Periférico/Conexão
01	VDD
02	OSC_IN
03	OSC_OUT
04	NRST_SWD
05	VDDA
06	ADC.FR
07	SW1
08	SW2
09	SW3
10	RS
11	ENB
12	DB4
13	DB5
14	DB6
15	DB7
16	GND
17	VDD
18	LED01
19	MCP_RX
20	MCP_TX
21	LED02
22	PA12
23	SWDIO
24	SWCLK
25	SPI1_NSS
26	SPI1_SCK
27	SPI1_MISO
28	SPI1_MOSI
29	SCL
30	SDA
31	BOOT0
32	GND

2.4.2 Interface com o usuário

Nesta subseção será apresentado o mapa de pinos da interface com o usuário, de acordo com a tabela 2.

Tabela 2: Mapa de pinos da interface com o usuário

Conecotor de expansão	Pino
Conecotor SWD	NRST_SWD SWCLK SWDIO GND SWD_3.3V SWD_5V
Conecotor de expansão - SPI	SPI1_MOSI SPI1_MISO SPI1_SCK SPI1_NSS GND VDD VDD_5V
Conecotor de expansão - I2C	SDA SCL GND VDD VDD_5V
Conecotor de expansão geral	PA12 GND VDD VDD_5V
Conecotor_SelectBootMode	VDD GND
BOOT0	BOOT0
Conecotor LCD	GND VDD_5V 3296W-1-103RLF RS GND ENB GND GND GND DB4 DB5 DB6 DB7 VDD_5V GND

3 Placa de circuito impresso - PCI

Nesta seção serão descritos os requisitos propostos para a PCI, as imagens da vista superior e inferior da placa, o relatório de erros e também um resumo sobre a alimentação para cada componente presente na placa.

3.1 Requisitos para a PCI

Os requisitos propostos para a PCI estão descritos na tabela 3.

Tabela 3: Requisitos para a PCI

Classe	Especificação
Características gerais da PCI	1 - Dimensão de até 50 cm^2 ; 2 - Dupla face; 3 - Identificação de componentes, conectores e os pinos destes; 4 - Identificação do discente e do semestre (2024.2); 5 - Quatro furos de fixação.
Espaçamento e dimensões de trilhas e afins	1 - Mínima largura para trilhas de sinais: 8 mils; 2 - Mínima largura para trilhas de alimentação: 12 mils; 3 - Mínimo espaçamento entre trilhas, furos e ilhas: 8 mils; 4 - Mínimo diâmetro de furo de vias: 12 mils; 5 - Mínimo diâmetro de ilhas de vias: 25 mils; 6 - Não utilizar microvias.

3.2 Imagens da PCI

Nesta subseção serão apresentadas imagens da vista superior e inferior da placa desenrolvida. A figura 11 apresenta a vista superior da placa 3D, enquanto a figura 12 apresenta a vista inferior da placa na visualização 3D e as figuras 13 e 14 representam as camadas da placa projetada. Em todas as figuras é possível perceber os detalhes para a confecção da placa, como por exemplo a disposição dos componentes e suas identificações.

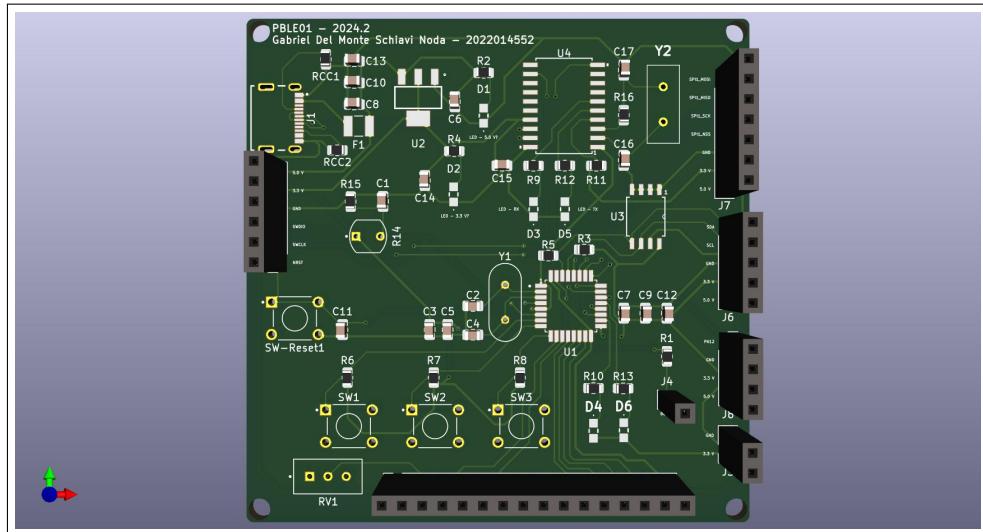


Figura 11: Visão superior da placa de circuito impresso - 3D

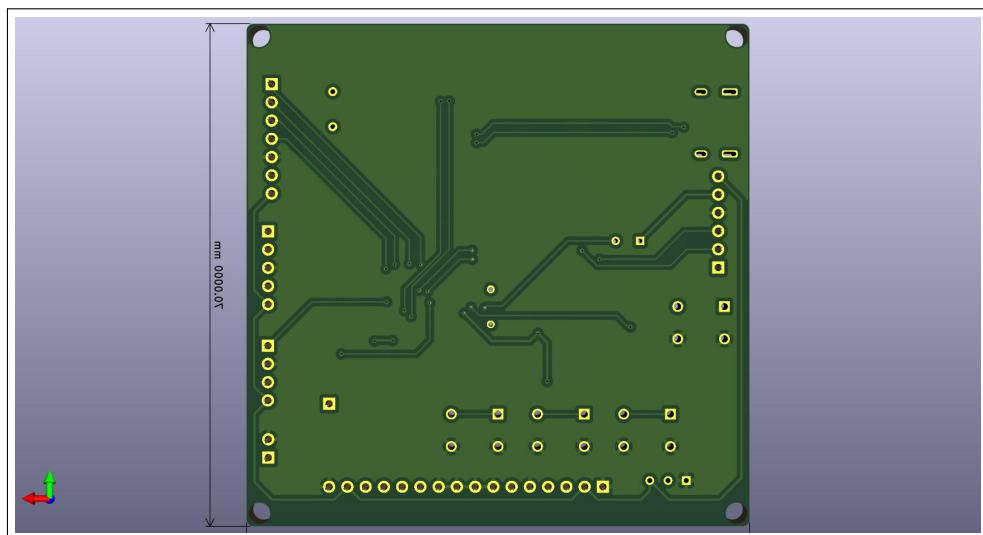


Figura 12: Visão inferior da placa de circuito impresso - 3D

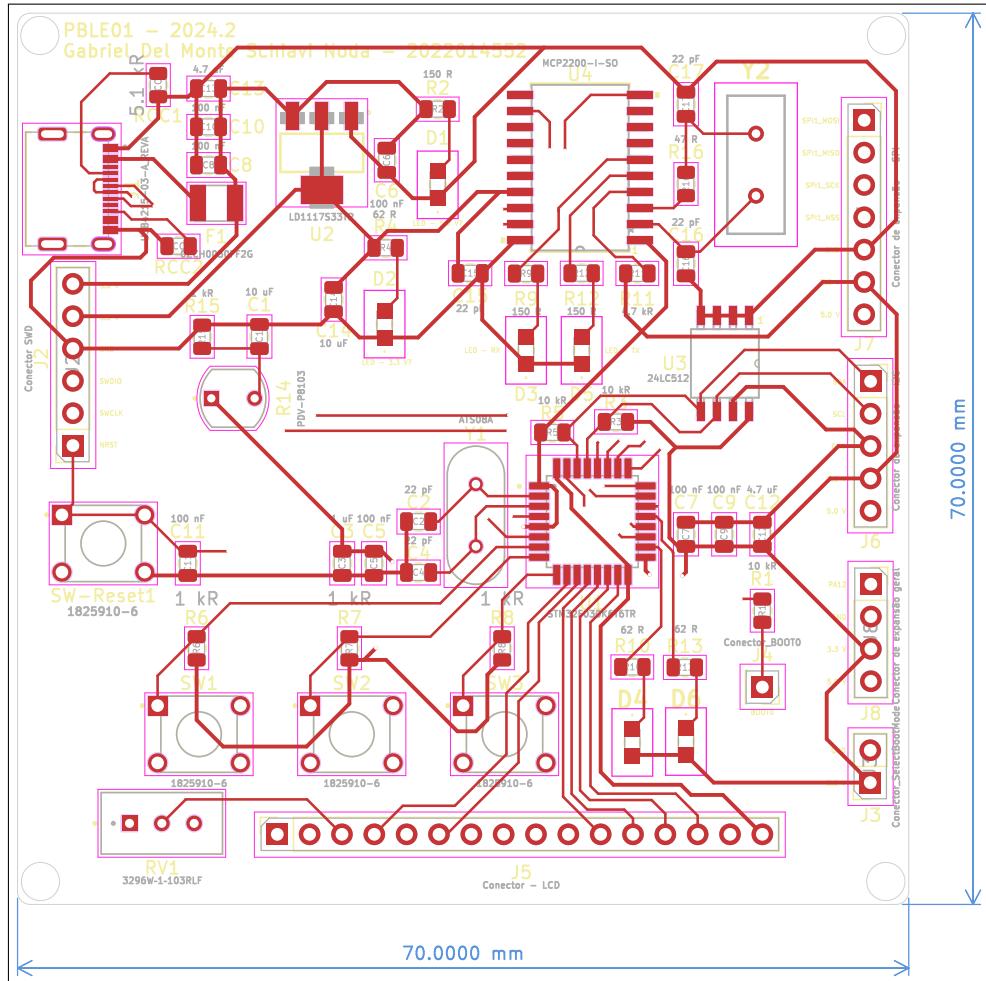


Figura 13: Camada superior da placa de circuito impresso - Kicad

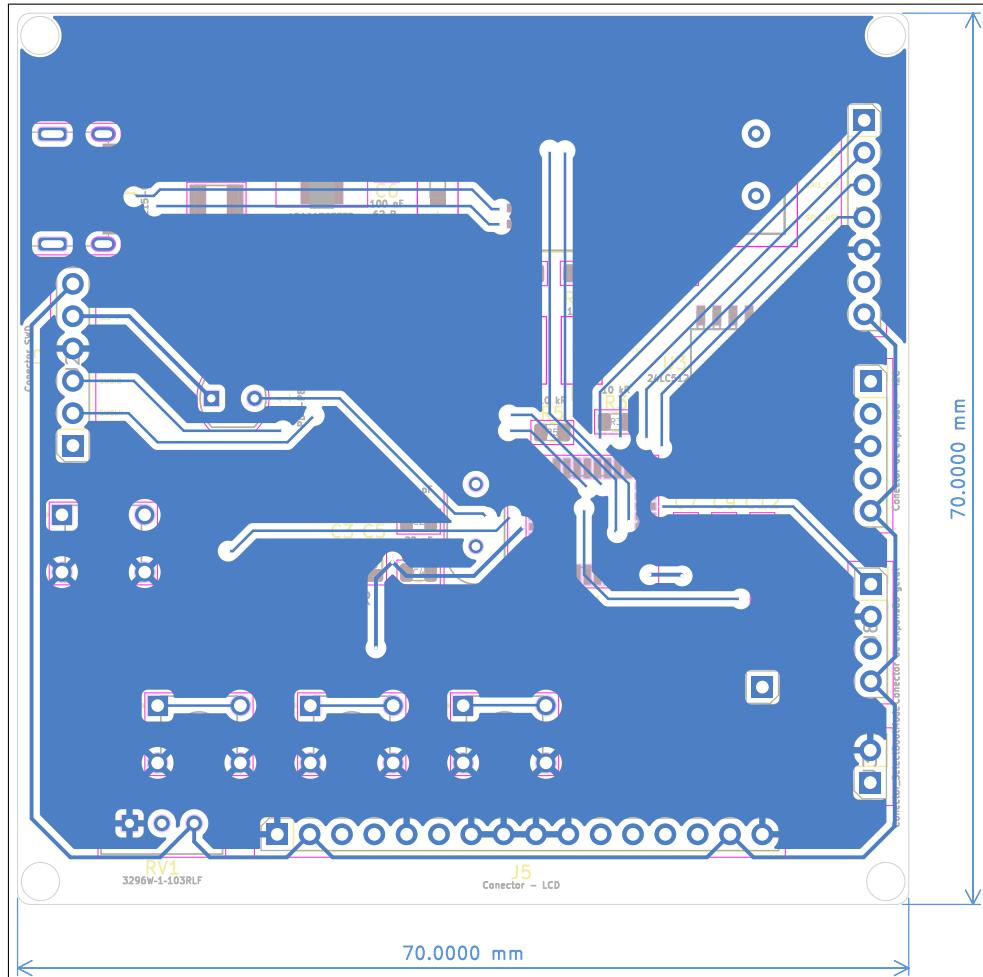


Figura 14: Camada inferior da placa de circuito impresso - Kicad

3.3 Relatório de erros

A partir da figura 15 é possível verificar o relatório de erros de projeto realizado pelo software Kicad.



Figura 15: Relatório de erros para a PCI - Kicad

3.4 Alimentação e consumo

Para o funcionamento da placa de forma total, é extremamente necessário fornecer para o circuito completo uma alimentação de 5.0 [V] para que todos os dispositivos que dependam deste nível de tensão estejam em estado funcional e além disso, ao fornecer este valor de tensão, os dispositivos que dependem do nível de tensão igual a 3.3 [V] também estarão funcionais por conta do regulador de tensão presente no circuito.

4 Apêndice

4.1 Memorial de cálculos

Nesta subseção serão descritos os cálculos realizados para a definição dos componentes utilizados no projeto que não foram descritos e/ou definidos por meio de seus respectivos datasheets.

4.1.1 R2

- Tensão de entrada (V_{in}): 5.0 [V];
- Tensão sobre o LED (V_{LED}): 2.1 [V];
- Corrente de operação do LED (I_{LED}): 20 [mA].

$$R2 = \frac{V_{in} - V_{LED}}{I_{LED}} = \frac{5.0 - 2.1}{20 \times 10^{-3}} = 145[\Omega]$$

Para garantir uma maior segurança ao circuito, o valor de R2 foi aproximado para 150 [Ω].

4.1.2 R4

- Tensão de entrada (V_{in}): 3.3 [V];
- Tensão sobre o LED (V_{LED}): 2.1 [V];
- Corrente de operação do LED (I_{LED}): 20 [mA].

$$R4 = \frac{V_{in} - V_{LED}}{I_{LED}} = \frac{3.3 - 2.1}{20 \times 10^{-3}} = 60[\Omega]$$

Para garantir uma maior segurança ao circuito, o valor de R4 foi aproximado para 62 [Ω].

4.1.3 R9

- Tensão de entrada (V_{in}): 5.0 [V];
- Tensão sobre o LED (V_{LED}): 2.1 [V];
- Corrente de operação do LED (I_{LED}): 20 [mA].

$$R9 = \frac{V_{in} - V_{LED}}{I_{LED}} = \frac{5.0 - 2.1}{20 \times 10^{-3}} = 145[\Omega]$$

Para garantir uma maior segurança ao circuito, o valor de R9 foi aproximado para 150 [Ω].

4.1.4 R10

- Tensão de entrada (V_{in}): 3.3 [V];
- Tensão sobre o LED (V_{LED}): 2.1 [V];
- Corrente de operação do LED (I_{LED}): 20 [mA].

$$R10 = \frac{V_{in} - V_{LED}}{I_{LED}} = \frac{3.3 - 2.1}{20 \times 10^{-3}} = 60[\Omega]$$

Para garantir uma maior segurança ao circuito, o valor de R10 foi aproximado para 62 [Ω].

4.1.5 R12

- Tensão de entrada (V_{in}): 5.0 [V];
- Tensão sobre o LED (V_{LED}): 2.1 [V];
- Corrente de operação do LED (I_{LED}): 20 [mA].

$$R12 = \frac{V_{in} - V_{LED}}{I_{LED}} = \frac{5.0 - 2.1}{20 \times 10^{-3}} = 145[\Omega]$$

Para garantir uma maior segurança ao circuito, o valor de R12 foi aproximado para 150 [Ω].

4.1.6 R13

- Tensão de entrada (V_{in}): 3.3 [V];
- Tensão sobre o LED (V_{LED}): 2.1 [V];
- Corrente de operação do LED (I_{LED}): 20 [mA].

$$R13 = \frac{V_{in} - V_{LED}}{I_{LED}} = \frac{3.3 - 2.1}{20 \times 10^{-3}} = 60[\Omega]$$

Para garantir uma maior segurança ao circuito, o valor de R13 foi aproximado para 62 [Ω].

4.2 Lista de compras

A tabela 4 apresenta os componentes utilizados na montagem da PCI, incluindo suas respectivas identificações, descrições, fabricantes, números de catálogo (*part number*), custos unitários e quantidades empregadas.

Tabela 4: Lista de compras

Item	Identificação	Descrição	Fabricante e part number	Custo (USD)	Qtd
01	R1, R3, R5	Resistor de 10 k Ω	Vishay, CRCW251210K0JNEGIF	0.69	3
02	R2, R9, R12	Resistor de 150 Ω	Vishay, CRCW251210K0JNEGIF	0.69	3
03	R4, R10, R13	Resistor de 62 Ω	Vishay, CRCW251210K0JNEGIF	0.69	3
04	R11	Resistor de 4.7 k Ω	Vishay, CRCW251210K0JNEGIF	0.69	1
05	R16	Resistor de 47 Ω	Vishay, CRCW251210K0JNEGIF	0.69	1
06	R6, R7, R8, R15	Resistor de 1 k Ω	Vishay, CRCW251210K0JNEGIF	0.69	4
07	RCC1, RCC2	Resistor de 5.1 k Ω	Vishay, CRCW251210K0JNEGIF	0.69	2
08	R14	Fotorresistor	Advanced Photonix, PDV-P8103	0.83	1

Item	Identificação	Descrição	Fabricante e part number	Custo (USD)	Qtd
09	C1, C14	Capacitor de 10 uF	TDK, C1608X7T1A106M080AC	0.22	2
10	C2, C4, C15, C16, C17	Capacitor de 22 pF	Vishay / Vitramon, VJ0402A220FXBAC	1.39	5
11	C5, C6, C7, C8, C9, C10, C11	Capacitor de 100 nF	KEMET, C0805R104J5RACTU	5.67	7
12	C3	Capacitor de 1 μ F	KYOCERA AVX, KAM15AR71C104KM	0.10	1
13	C12, C13	Capacitor de 4.7 μ F	KYOCERA AVX, KAF32LL81H475KU	0.95	2
14	U1	Microcontrolador STM32F030K6T6TR	STMicroelectronics, STM32F030K6T6TR	1.69	1
15	U2	Regulador de tensão para 3.3 [V]	STMicroelectronics, LD1117S33TR	0.34	1
16	U3	Memória EEPROM	Microchip Technology, 24LC512-I/SN	1.70	1
17	U4	Transceptor USB-Serial	Microchip Technology, MCP2200-I/SO	2.61	1
18	D1, D2, D3, D4, D5, D6	Diodo emissor de luz	Bivar, SM0805UOC	0.20	6
19	F1	Fusível restaurável	Bel Fuse, 0ZCH0050FF2G	0.16	1
20	SW-Reset1, SW1, SW2, SW3	Chave táctil	TE Connectivity, 1825910-6	0.14	4
21	Y1	Cristal de 8 MHz	CTS Electronic Components, ATS08A	0.60	1
22	Y2	Cristal de 12 MHz	CTS Electronic Components, ATS12A	0.30	1
23	J2	Header Vertical 01x06	Harwin, M20-7820646	1.33	1
24	J5	Header Vertical 01x16	Harwin, M20-7821642	2.48	1
25	J6	Header Vertical 01x05	Harwin, M20-7820542	1.07	1
26	J7	Header Vertical 01x07	Harwin, M22-7130742	1.10	1
27	J8	Header Vertical 01x04	Harwin, M20-7820446	1.02	1
28	J3	Header Vertical 01x02	Harwin, M50-3030242	0.66	1
29	J4	Header Vertical 01x01	Harwin, M50-3030242	0.66	1
30	RV1	Trimmer de 10k Ω	Bourns, 3296W-1-103RLF	3.14	1
31	J1	Conecotor USB tipo C	GCT, 640-USB4215-03-A	0.59	1

4.3 Ambiente de desenvolvimento

Tabela 5: Ambiente de desenvolvimento para o projeto

Recurso	Descrição	Versão
01	Kicad	8.99
02	LaTeX/Overleaf	-

5 Anexos

5.1 Folhas de rosto de componentes



**Surface Mount PTC
0ZCH Series**

[HF] [Pb] 0ZCH Series – 1210 Chip RoHS 2 Compliant

Product Features

- 1210 Chip Size, Fast Trip Time, Low DCR Resistance
- AEC-Q Compliant
- Meets Bel automotive qualification*
- * - Largely based on internal AEC-Q test plan

Operating (Hold Current) Range
50mA - 2A

Maximum Voltage
6 - 60V (per table)

Temperature Range
-40°C to 85°C

Agency Approval
TUV (Std. EN/IEC 60738-1-1 and EN/IEC 60730-1, Cert. R50102117)
UL Recognized Component (Std. UL1434, File E305051)

AEC-Q Compliant LEAD FREE = **[Pb]** HALOGEN FREE = **[HF]**

Electrical Characteristics (23°C)												
	Part Number	Hold Current	Trip Current	Rated Voltage	Maximum Current	Typical Power	Max Time to Trip		Resistance Tolerance		Agency Approvals	
		I _h , A	I _t , A	V _{max} , Vdc	I _{max} , A	P _d , W	A	Sec	R _{min} , Ohms	R _{1max} , Ohms	c UL us	△ TÜV
A	0ZCH0005FF2E	0.05	0.15	60	10	0.60	0.25	1.50	3.600	50.000	Y Y	
B	0ZCH0010FF2E	0.10	0.25	60	10	0.60	0.50	1.50	1.600	15.000	Y Y	
C	0ZCH0020FF2E	0.20	0.40	30	10	0.60	8.00	0.02	0.800	5.000	Y Y	
D	0ZCH0035FF2G	0.35	0.70	16	100	0.60	8.00	0.20	0.320	1.300	Y Y	
E	0ZCH0050FF2G	0.50	1.00	16	100	0.60	8.00	0.10	0.250	0.900	Y Y	
F	0ZCH0075FF2G	0.75	1.50	8	100	0.60	8.00	0.10	0.130	0.400	Y Y	
	0ZCH0075AF2E	0.75	1.50	24	100	0.60	8.00	0.10	0.130	0.400	Y Y	
G	0ZCH0110FF2E	1.10	2.20	8	100	0.80	8.00	0.30	0.060	0.210	Y Y	
	0ZCH0110AF2E	1.10	2.20	16	100	0.80	8.00	0.30	0.060	0.210	Y Y	
H	0ZCH0150FF2E	1.50	3.00	6	100	0.80	8.00	0.50	0.040	0.110	Y Y	
I	0ZCH0175FF2E	1.75	3.50	6	100	0.80	8.00	0.60	0.020	0.080	Y Y	
J	0ZCH0200FF2E	2.00	4.00	6	100	0.80	8.00	1.00	0.015	0.070	Y Y	

New Rating

I_h Hold Current- The maximum current at which the device will not trip in still air at 23°C.
I_t Trip current- The minimum current at which the device will trip in still air at 23°C.
V_{max} Maximum voltage device can withstand at its rated current without suffering damage.
I_{max} Maximum fault current device can withstand at rated voltage (V_{max}) without damage.
P_d Typical power dissipated by device when in tripped state in 23°C still air environment.
R_{min} Minimum device resistance at 23°C in initial un-soldered state.
R_{1max} Maximum device resistance at 23°C, 1 hour after initial device trip, or after being soldered to PCB in end application.



Specifications subject to change without notice

belfuse.com/circuit-protection

Figura 16: Folha de rosto: 0ZCH0050FF2G



24AA512/24LC512/24FC512

512K I²C Serial EEPROM

Device Selection Table

Part Number	Vcc Range	Max. Clock Frequency	Temp. Ranges	Available Packages
24AA512	1.7-5.5V	400 kHz ⁽¹⁾	I	CSP, MF, P, SM, SN, ST, ST14
24LC512	2.5-5.5V	400 kHz	I, E	MF, P, SM, SN, ST, ST14
24FC512	1.7-5.5V	1 MHz ⁽²⁾	I	MF, Q4B, P, OT, SM, SN, ST, ST14

Note 1: 100 kHz for Vcc < 2.5V

2: 400 kHz for Vcc < 2.5V

Features

- Single Supply with Operation down to 1.7V for 24AA512 and 24FC512 Devices and 2.5V for 24LC512 Devices
- Low-Power CMOS Technology:
 - Read current: 400 μ A, maximum
 - Standby current: 1 μ A maximum (I-Temp.)
- Two-Wire Serial Interface, I²C Compatible
- Cascadable for up to Eight Devices
- Schmitt Trigger Inputs for Noise Suppression
- Output Slope Control to Eliminate Ground Bounce
- 100 kHz, 400 kHz and 1 MHz Clock Compatibility
- Page Write Time: 5 ms, Maximum
- Self-Timed Erase/Write Cycle
- 128-Byte Page Write Buffer
- Hardware Write-Protect
- ESD Protection: >4000V
- More than 1 Million Erase/Write Cycles
- Data Retention: >200 years
- RoHS Compliant
- Temperature Ranges:
 - Industrial (I): -40°C to +85°C
 - Extended (E): -40°C to +125°C
- Automotive AEC-Q100 Qualified

Packages

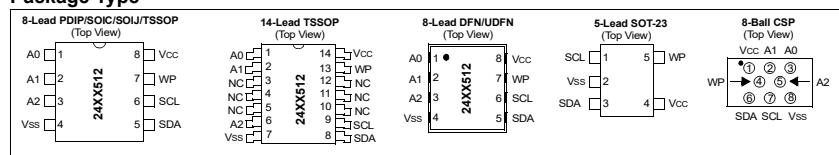
- 8-Lead SOIC, 8-Lead SOIJ, 8-Lead TSSOP, 14-Lead TSSOP, 8-Lead DFN, 8-Lead UDFN, 8-Lead PDIP, 5-Lead SOT-23 and 8-Ball CSP

Description

The Microchip Technology Inc. 24XX512⁽¹⁾ is a 512 Kbit Electrically Erasable PROM. The device is organized as one block of 64K x 8-bit memory with a two-wire serial interface. Its low-voltage design permits operation down to 1.7V, with standby and active currents of only 1 μ A and 400 μ A, respectively. The 24XX512 also has a page write capability for up to 128 bytes of data. This device is capable of both random and sequential reads up to the 512K boundary. Functional address lines allow up to eight devices on the same bus, for up to 4 Mbit address space.

Note 1: 24XX512 is used in this document as a generic part number for the 24AA512/24LC512/24FC512 devices.

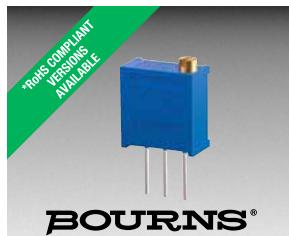
Package Type



© 2008-2021 Microchip Technology Inc.

DS20001754Q-page 1

Figura 17: Folha de rosto: 24LC512



BOURNS®

Features

- Multiturn / Cermet / Industrial / Sealed
- 5 terminal styles
- Tape and reel packaging available
- Chevron seal design
- Listed on the QPL for style [RJ24](#) per MIL-R-22097 and [RJR24](#) per High-Rel Mil-R-39035
- Mounting hardware available ([H-117P](#))
- RoHS compliant* version available
- For trimmer applications/processing guidelines, [click here](#)

3296 - 3/8" Square Trimpot® Trimming Potentiometer

Additional Information

Click these links for more information:



Electrical Characteristics

Standard Resistance Range 10 ohms to 2 megohms (see standard resistance table)
Resistance Tolerance $\pm 10\%$ std. (tighter tolerance available)
Absolute Minimum Resistance 1% or 2 ohms max. (whichever is greater)
Contact Resistance Variation 1.0% or 3 ohms max. (whichever is greater)
Adjustability	
Voltage $\pm 0.01\%$
Resistance $\pm 0.05\%$
Resolution Infinite
Insulation Resistance 500 VDC 1,000 megohms min.
Dielectric Strength	
Sea Level 900 VAC
70,000 Feet 350 VAC
Effective Travel 25 turns nom.

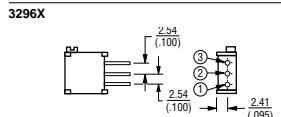
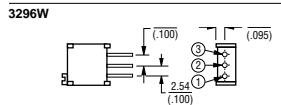
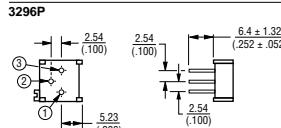
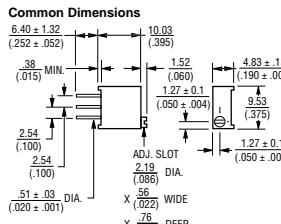
Environmental Characteristics

Power Rating (300 volts max.)	
70 °C 0.5 watt
125 °C 0 watt
Temperature Range -55 °C to +125 °C
Temperature Coefficient $\pm 100 \text{ PPM/C}$
Seal Test 85 °C
Humidity MIL-STD-202 Method 103 96 hours (2 % Δ TR, 10 Megohms IR)
Vibration 20 G (1 % Δ TR, 1 % Δ VR)
Shock 100 G (1 % Δ TR, 1 % Δ VR)
Load Life 1,000 hours 0.5 watt @ 70 °C (3 % Δ TR; 3 % or 3 ohms, whichever is greater, CRV)
Rotational Life 200 cycles (4 % Δ TR; 3 % or 3 ohms, whichever is greater, CRV)
Moisture Sensitivity Level N/A
ESD Classification (HBM) 2

Physical Characteristics

Torque 3.0 oz-in. max.
Mechanical Stops Wiper idles
Terminals Solderable pins
Weight 0.03 oz.
Marking Manufacturer's trademark, resistance code, wiring diagram, date code, mfr's. model number and style
Wiper 50 % (Actual TR) $\pm 10\%$
Flammability UL 94V-0
Standard Packaging 50 pcs. per tube
Adjustment Tool H-90
Storage Condition 40 °C max. / 70 % R.H. max.

Product Dimensions



Standard Resistance Table

Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205

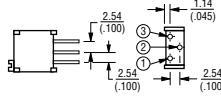
Popular values listed in **boldface**. Special resistances available.



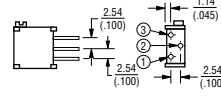
WARNING Cancer and Reproductive Harm

[www.P65Warnings.ca.gov](#)

3296Y



3296Z



WIPER
CCW (1) —————> COUNTER CLOCKWISE
CW (3) —————> CLOCKWISE

DIMENSIONS: **MM**
(INCHES)

TOLERANCES: ± 0.25
(.010) EXCEPT WHERE NOTED

How To Order

3296 W - 1 - 103 LF

Model	_____
Style	_____
Standard or Modified	_____
Product Indicator	_____
-1 = Standard Product	_____
Resistance Code	_____

Packaging Designator
Blank = Tube (Standard)
R = Tape and Reel (X and W Pin Styles Only)

A = Ammo Pack (X and W Pin Styles Only)

Tape and reel material meets Antistatic ANSI/ESD SS 5541-2003 packaging standards.

Terminations
LF = 100 % Tin-plated (RoHS compliant)
Blank = 90 % Tin / 10 % Lead-plated (Standard)

Consult factory for other available options.

*RoHS Directive 2015/863, Mar. 31, 2015 and Annex "Trimpot" is a trademark of Bourns, Inc.

Specifications are subject to change without notice.

Users should verify actual device performance in their specific applications. The products described herein and this document are subject to specific legal disclaimers as set forth on the last page of this document, and at [www.bourns.com/docs/legal/disclaimer.pdf](#).

Figura 18: Folha de rosto: 3296W-1-103RLF



Switches Core Program

 **Tyco Electronics**
Our commitment. Your advantage.

Figura 19: Folha de rosto: 1825910-6



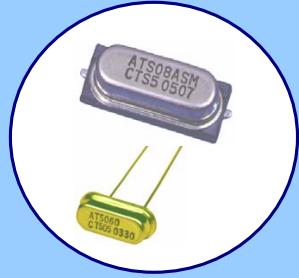
ATS/ATS-SM SERIES

QUARTZ CRYSTAL



FEATURES

- Standard HC-49/US [thru-hole] and HC-49/US-SM [surface mount] Packages
- Stable Frequency Over Temperature and Drive Level
- Fundamental and 3rd Overtone Crystals
- Frequency Range 3.2 – 64 MHz
- Frequency Tolerance, ±30 ppm Standard
- Frequency Stability, ±50 ppm Standard
- Operating Temperature, -20°C to +70°C Standard, -40°C to +85°C Available
- Tape & Reel Packaging Available
- RoHS/Green Compliant [6/6]

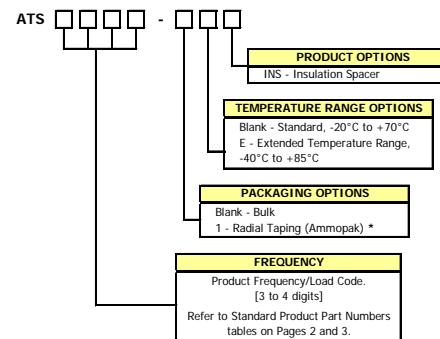


APPLICATIONS

The ATS/ATS-SM crystal series offers excellent long-term stability and reliability in a proven resistance-weld metal package. The excellent shock performance makes it suitable for microprocessor, telecommunication, industrial, consumer electronics and networking applications.

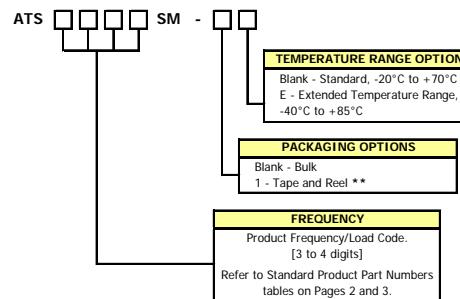
ORDERING INFORMATION

ATS



* Standard packaging is bulk in a bag.

ATS-SM



** Standard packaging is tape and reel.
CTS Distributors may use -T for tape and reel indicator.

Non-Standard Ordering Options

- Contact your local CTS Representative or CTS Inside Sales Representative for assistance.

Figura 20: Folha de rosto: ATS08A



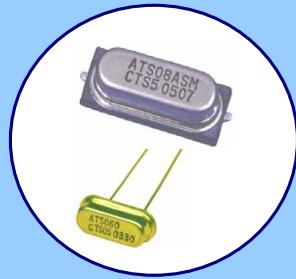
ATS/ATS-SM SERIES

QUARTZ CRYSTAL



FEATURES

- Standard HC-49/US [thru-hole] and HC-49/US-SM [surface mount] Packages
- Stable Frequency Over Temperature and Drive Level
- Fundamental and 3rd Overtone Crystals
- Frequency Range 3.2 – 64 MHz
- Frequency Tolerance, ±30 ppm Standard
- Frequency Stability, ±50 ppm Standard
- Operating Temperature, -20°C to +70°C Standard, -40°C to +85°C Available
- Tape & Reel Packaging Available
- RoHS/Green Compliant [6/6]

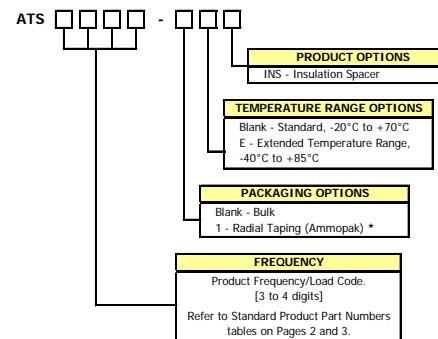


APPLICATIONS

The ATS/ATS-SM crystal series offers excellent long-term stability and reliability in a proven resistance-weld metal package. The excellent shock performance makes it suitable for microprocessor, telecommunication, industrial, consumer electronics and networking applications.

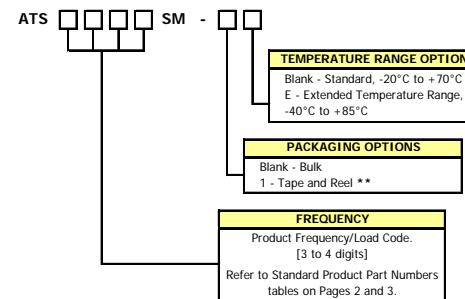
ORDERING INFORMATION

ATS



* Standard packaging is bulk in a bag.

ATS-SM



** Standard packaging is tape and reel.
CTS Distributors may use -T for tape and reel indicator.

Non-Standard Ordering Options

- Contact your local CTS Representative or CTS Inside Sales Representative for assistance.

Figura 21: Folha de rosto: ATS12A

Automotive MLCC, KAM Series

General Specifications



GENERAL DESCRIPTION

KYOCERA AVX has supported the Automotive Industry requirements for Multilayer Ceramic Capacitors consistently for more than 25 years. Products have been developed and tested specifically for automotive applications and all manufacturing facilities are QS9000 and VDA 6.4 approved.

KYOCERA AVX is using AECQ200 as the qualification vehicle for this transition. A detailed qualification package is available on request and contains results on a range of part numbers.

The KAM series are plated with a Nickel/Tin finish. For FLEXITERM® please refer to the KAF series datasheet.

HOW TO ORDER

KAM	31	G	R7	1H	475	K	U
Series	Size	Thickness	Dielectric	Voltage	Capacitance Code Code (in pF)	Capacitance Tolerance	Packaging
AEC-Q200	03 = 0201	See Cap Chart	CG = COG	0G = 4V	2 Significant Digits +Number of zeros eg 10uF = 106	B = ± 0.1pF (<10pF)* C = ± 0.25pF (<10pF)*	See Table Below
Tin Nickel Finish	05 = 0402		R7 = X7R	0J = 6.3V		D = ± 0.5pF (<10pF)*	
	15 = 0603		S7 = X7S	1A = 10V		F = ± 1%*	
	21 = 0805		T7 = X7T	1C = 16V		G = ± 2%*	
	31 = 1206		R8 = X8R	1E = 25V		J = ± 5%	
	32 = 1210		L8 = X8L	1H = 50V		K = ± 10%	
	42 = 1808		G8 = X8G	2A = 100V		M = ± 20%	
	43 = 1812			2D = 200V			
	55 = 2220			2E = 250V			
				2H = 500V			
				2J = 630V			
				3A = 1000V			
				3N = 1500V			
				3D = 2000V			
				3E = 2500V			
				3U = 3000V			

*COG only

PACKAGING CODES

Code	EIA (inch)	IEC(mm)	7" Paper	7" Embossed	13" Paper	13" Embossed
03	0201	0603	H		N	
05	0402	1005	H		N	
15	0603	1608	T	U	M	L
21	0805	2012	T	U	M	L
31	1206	3216	T	U	M	L
32	1210	3225	T	U	M	L
42	1808	4520		Y		K
43	1812	4532		V		S
55	2220	5750		V		S

*thickness determines paper or plastic embossed packaging

DIELECTRIC

Dielectric	Operating Temperature (°C)	Capacitance Change Rate
X7R	-55~+125	±15%
X7T	-55~+125	±22/-33%
X8R	-55~+150	±15%
X8L	-55~+125	±15%
X8L	+125~+150	+15/-40%
X8G	-55~+150	0±30ppm/°C
NP0	-55~+125	0±30ppm/°C

The Important Information/Disclaimer is incorporated in the catalog where these specifications came from or available online at www.kyocera-avx.com/disclaimer/ by reference and should be reviewed in full before placing any order.

TDS-SMDMLCC-0033 | Rev 8

1

— SURFACE MOUNT CERAMIC CAPACITOR PRODUCTS —

Figura 22: Folha de rosto: Capacitor 1 μ F

Automotive MLCC with FLEXITERM®, KAF Series

General Specifications



GENERAL DESCRIPTION

With increased requirements from the automotive industry for additional component robustness, KYOCERA AVX recognized the need to produce a MLCC with enhanced mechanical strength. It was noted that many components may be subject to severe flexing and vibration when used in various under the hood automotive and other harsh environment applications.

To satisfy the requirement for enhanced mechanical strength, KYOCERA AVX had to find a way of ensuring electrical integrity is maintained whilst external forces are being applied to the component. It was found that the structure of the termination needed to be flexible and after much research and development, KYOCERA AVX launched FLEXITERM®. FLEXITERM® is designed to enhance the mechanical flexure and temperature cycling performance of a standard ceramic capacitor. The industry standard for flexure is 2mm minimum. Using FLEXITERM®, KYOCERA AVX provides up to 5mm of flexure without internal cracks. Beyond 5mm, the capacitor will generally fail "open".

As well as for automotive applications FLEXITERM® will provide Design Engineers with a satisfactory solution when designing PCB's which may be subject to high levels of board flexure.

PRODUCT ADVANTAGES

- High mechanical performance able to withstand, 5mm bend test guaranteed
- Increased temperature cycling performance, 3000 cycles and beyond
- Flexible termination system
- Reduction in circuit board flex failures
- Base metal electrode system
- Automotive or commercial grade products available
- AECQ200 Qualified
- Approved to VW 80808 Specification

APPLICATIONS

High Flexure Stress Circuit Boards

- e.g. Depanelization: Components near edges of board.

Variable Temperature Applications

- Soft termination offers improved reliability performance in applications where there is temperature variation.
- e.g. All kind of engine sensors: Direct connection to battery rail.

Automotive Applications

- Improved reliability.
- Excellent mechanical performance and thermo mechanical performance.

HOW TO ORDER

KAF	31	G	R7	1H	475	K	U	
Series AEC-Q200 FLEXITERM® SERIES	Size 15 = 0603 21 = 0805 31 = 1206 32 = 1210 42 = 1808 43 = 1812 55 = 2220	Thickness See Cap Chart	Dielectric CG = COG R7 = X7R R8 = X8R L8 = X8L G8 = X8G	0J = 6.3V 1A = 10V 1C = 16V 1E = 25V 1H = 50V 2A = 100V 2D = 200V 2E = 250V	2H = 500V 2J = 630V 3A = 1000V 3N = 1500V 3D = 2000V 3E = 2500V 3U = 3000V	Capacitance Code Code (in pF) 2 Significant Digits *Number of zeros eg 100 μ F = 106 10nF = 103 47pF = 470	Capacitance Tolerance B = $\pm 0.1\mu$ F ($<10\mu$ F)* C = $\pm 0.25\mu$ F ($<10\mu$ F)* D = $\pm 0.5\mu$ F ($<10\mu$ F)* F = $\pm 1\%$ * G = $\pm 2\%$ * J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	Packaging See Table Below

NOTE: Contact factory for availability of Tolerance Options for Specific Part Numbers.

*COG only

PACKAGING CODES

Code	EIA (inch)	IEC (mm)	7" Paper	7" Embossed	13" Paper	13" Embossed
15	0603	1608	T	U	M	L
21	0805	2012	T	U	M	L
31	1206	3216	T	U	M	L
32	1210	3225	T	U	M	L
42	1808	4520		Y		K
43	1812	4532		V		S
55	2220	5750		V		S

*thickness determines paper or plastic embossed packaging

The Important Information/Disclaimer is incorporated in the catalog where these specifications came from or available online at www.kyocera-avx.com/disclaimer/ by reference and should be reviewed in full before placing any order.

1

TDS-SMDMLCC-0034 | Rev 7

— SURFACE MOUNT CERAMIC CAPACITOR PRODUCTS —

Figura 23: Folha de rosto: Capacitor 4.7 μ F



MULTILAYER CERAMIC CHIP CAPACITORS

Commercial grade, general (Up to 75V)

C series

C0402	[01005 inch]
C0603	[0201 inch]
C1005	[0402 inch]
C1608	[0603 inch]
C2012	[0805 inch]
C3216	[1206 inch]
C3225	[1210 inch]
C4532	[1812 inch]
C5750	[2220 inch]

* Dimensions code: JIS[EIA]

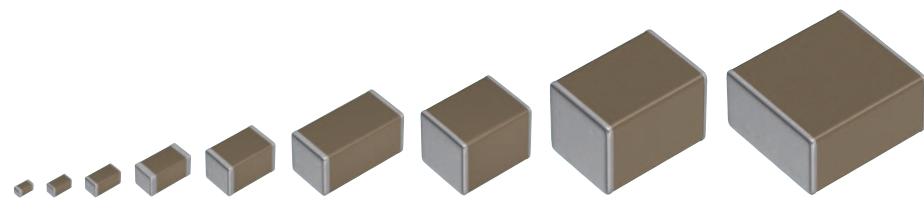


Figura 24: Folha de rosto: Capacitor 10 μF



www.vishay.com

VJ Commercial Series

Vishay Vitramon

Surface Mount Multilayer Ceramic Chip Capacitors for Commercial Applications



FEATURES

- COG (NP0) and X7R dielectrics offered
- COG (NP0) is an ultra-stable dielectric offering a very low Temperature Coefficient of Capacitance (TCC)
- COG (NP0) offers low dissipation
- Excellent aging characteristics
- Ideal for decoupling and filtering (X7R)
- Ideal for surge suppression and high voltage applications
- Wide range of case sizes, voltage ratings and capacitance values
- Wet build process
- Reliable Noble Metal Electrode (NME) system
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



COMPLIANT

HALOGEN

FREE

GREEN

(E-2008)

Available

APPLICATIONS

- Timing and tuning circuits
- Sensor and scanner applications
- Decoupling and filtering
- Surge suppression

ELECTRICAL SPECIFICATIONS

COG (NP0) DIELECTRIC	X7R DIELECTRIC
GENERAL SPECIFICATION Note Electrical characteristics at +25 °C unless otherwise specified Operating Temperature: -55 °C to +150 °C (above +125 °C changed characteristics) Capacitance Range: 1 pF to 56 nF Voltage Range: 25 V _{DC} to 1000 V _{DC} Temperature Coefficient of Capacitance (TCC): 0 ppm/°C ± 30 ppm/°C from -55 °C to +125 °C Dissipation Factor (DF): 0.1 % maximum at 1.0 V _{RMS} and 1 MHz for values ≤ 1000 pF 0.1 % maximum at 1.0 V _{RMS} and 1 kHz for values > 1000 pF Insulating Resistance: at +25 °C 100 000 MΩ min. or 1000 MΩ whichever is less at +125 °C 10 000 MΩ min. or 100 MΩ whichever is less Aging Rate: 0 % maximum per decade Dielectric Strength Test: performed per method 103 of EIA 198-2-E. Applied test voltages ≤ 200 V _{DC} -rated: 250 % of rated voltage 500 V _{DC} -rated: 200 % of rated voltage 630 V _{DC} , 1000 V _{DC} -rated: 150 % of rated voltage	GENERAL SPECIFICATION Note Electrical characteristics at +25 °C unless otherwise specified Operating Temperature: -55 °C to +150 °C (above +125 °C changed characteristics) Capacitance Range: 120 pF to 6.8 μF Voltage Range: 16 V _{DC} to 1000 V _{DC} Temperature Coefficient of Capacitance (TCC): ± 15 % from -55 °C to +125 °C, with 0 V _{DC} applied Dissipation Factor (DF): 16 V/25 V ratings: 3.5 % maximum at 1.0 V _{RMS} and 1 kHz > 25 V ratings: 2.5 % maximum at 1.0 V _{RMS} and 1 kHz Insulating Resistance: at +25 °C 100 000 MΩ min. or 1000 MΩ whichever is less at +125 °C 10 000 MΩ min. or 100 MΩ whichever is less Aging Rate: 1 % maximum per decade Dielectric Strength Test: performed per method 103 of EIA 198-2-E. Applied test voltages ≤ 250 V _{DC} -rated: 250 % of rated voltage 500 V _{DC} -rated: min. 150 % of rated voltage 630 V _{DC} , 1000 V _{DC} -rated: min. 120 % of rated voltage

Revision: 12-Dec-2023

1

Document Number: 45199

For technical questions, contact: mlcc@vishay.com

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ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

Figura 25: Folha de rosto: Capacitor 22 pF

Surface Mount Multilayer Ceramic Chip Capacitors (SMD MLCCs)

High Temperature 175°C, X7R Dielectric, 16 – 200 VDC (Industrial Grade)



Overview

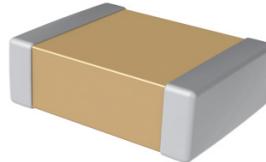
KEMET's High Temperature X7R Dielectric capacitors are formulated and designed for extreme temperature applications. Constructed of a robust and proprietary base metal electrode (BME) dielectric system, these devices are capable of reliable operation in temperatures up to 175°C. Providing an attractive combination of performance and robustness in general high temperature applications, High Temperature X7R dielectric capacitors are well suited for high temperature bypass and decoupling applications or frequency discriminating circuits where Q and stability of capacitance characteristics are not critical. They exhibit a predictable change in capacitance with respect to time, voltage and temperature up to 175°C.

KEMET's High Temperature X7R surface mount MLCCs are manufactured in state of the art ISO/TS 16949:2009 certified facilities and are proven to function reliably in harsh, high temperature and high humidity, down-hole environments.

Concerned with flex cracks resulting from excessive stresses produced during board flexure and thermal cycling? These devices are available with KEMET's Flexible termination technology which inhibits the transfer of board stress to the rigid ceramic body, therefore mitigating flex cracks which can result in low IR or short circuit failures. Although flexible termination technology does not eliminate the potential for mechanical damage that may propagate during extreme environmental and handling conditions, it does provide superior flex performance over standard termination systems.

Benefits

- Operating temperature range of -55°C to +175°C
- Voltage derating not required
- Lead (Pb)-free, RoHS and REACH compliant
- Base metal electrode (BME) dielectric system
- EIA 0402, 0603, 0805, 1206, 1210, and 1812 case sizes
- DC voltage ratings of 16 V, 25 V, 50 V, 100 V, and 200 V
- Capacitance offerings ranging from 2.7 nF to 3.3 µF
- Available capacitance tolerances of ±5%, ±10% & ±20%
- Non-polar device, minimizing installation concerns
- 100% pure matte tin-plated termination finish allowing for excellent solderability
- SnPb termination finish option available (5% Pb minimum)
- Flexible termination option available upon request



Applications

- Decoupling
- Bypass
- Filtering
- Transient voltage suppression

Application Notes

X7R dielectric is not recommended for AC line filtering or pulse applications.

Voltage derating of these capacitors is not required for application temperatures up to 175°C.

Built Into Tomorrow

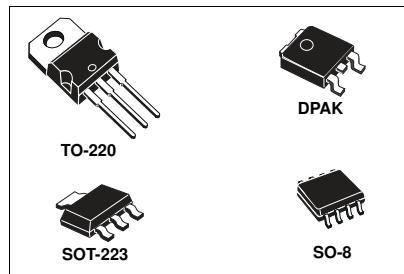
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C1075_X7R-HT_SMD • 8/14/2024 1

Figura 26: Folha de rosto: Capacitor 100 nF

Adjustable and fixed low drop positive voltage regulator

Datasheet - production data



Features

- Low dropout voltage (1 V typ.)
- 2.85 V device performances are suitable for SCSI-2 active termination
- Output current up to 800 mA
- Fixed output voltage of: 1.2 V, 1.8 V, 2.5 V, 3.3 V, 5.0 V
- Adjustable version availability ($V_{REF} = 1.25$ V)
- Internal current and thermal limit
- Available in $\pm 1\%$ (at 25 °C) and 2 % in full temperature range
- Supply voltage rejection: 75 dB (typ.)

Description

The LD1117 is a low drop voltage regulator able to provide up to 800 mA of output current, available even in adjustable version ($V_{REF} = 1.25$ V). Concerning fixed versions, are offered the following output voltages: 1.2 V, 1.8 V, 2.5 V, 2.85 V, 3.3 V and 5.0 V. The device is supplied in: SOT-223, DPAK, SO-8 and TO-220. The SOT-223 and DPAK surface mount packages optimize the thermal characteristics even offering a relevant space saving effect. High efficiency is assured by NPN pass transistor. In fact in this case, unlike than PNP one, the quiescent current flows mostly into the load. Only a very common 10 μ F minimum capacitor is needed for stability. On chip trimming allows the regulator to reach a very tight output voltage tolerance, within $\pm 1\%$ at 25 °C. The adjustable LD1117 is pin to pin compatible with the other standard. Adjustable voltage regulators maintaining the better performances in terms of drop and tolerance.

Figura 27: Folha de rosto: LD1117S33TR



MCP2200

USB 2.0 to UART Protocol Converter with GPIO

Features

Universal Serial Bus (USB)

- Supports Full-Speed USB (12 Mb/s)
- Implements USB Protocol Composite Device:
 - Communication Device Class (CDC) for Communications and Configuration
 - Human Interface Device (HID) for I/O control
- 128-Byte Buffer to Handle Data Throughput at Any UART Baud Rate:
 - 64-byte transmit
 - 64-byte receive
- Fully Configurable VID and PID Assignments and String Descriptors
- Bus-Powered or Self-Powered
- USB 2.0 Compliant: TID 40001150

USB Driver and Software Support

- Uses Standard Windows® Drivers for Virtual Com Port (VCP): Windows XP (SP2 or later), Windows Vista, Windows 7, Windows 8, Windows 8.1 and Windows 10
- Configuration Utility for Initial Configuration

Universal Asynchronous Receiver/Transmitter (UART)

- Responds to SET_LINE_CODING Commands to Dynamically Change Baud Rates
- Supports Baud Rates: 300-1000k
- Hardware Flow Control
- UART Signal Polarity Option

General Purpose Input/Output (GPIO) Pins

- Eight General Purpose I/O pins

EEPROM

- 256 Bytes of User EEPROM

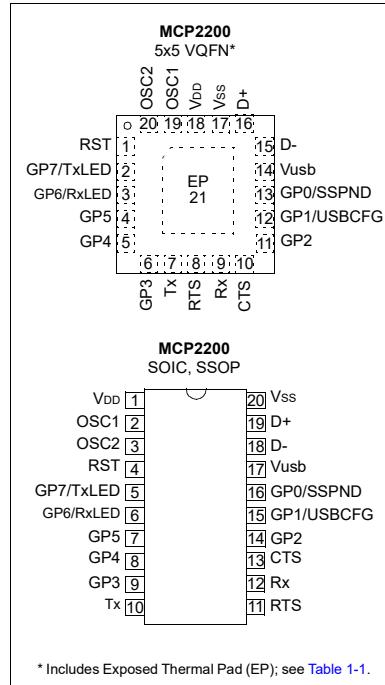
Other

- USB Activity LED Outputs (TxLED and RxLED)
- SSPND Output Pin
- USBCFG Output Pin (indicates when the enumeration is completed)
- Operating Voltage: 3.0V-5.5V
- Oscillator Input: 12 MHz
- Electrostatic Discharge (ESD) Protection: >4 kV Human Body Model (HBM)
- Industrial (I) Operating Temperature: -40°C to +85°C
- Passes Automotive AEC-Q100 Reliability Testing

Package Types

The device is offered in the following packages:

- 20-lead VQFN (5x5 mm)
- 20-lead SOIC
- 20-lead SSOP



* Includes Exposed Thermal Pad (EP); see [Table 1-1](#).

Figura 28: Folha de rosto: MCP2200



PDV-P8103

0.5MΩ Dark Resistance Light Dependent Resistor (LDR) CdS Photocell

The PDV-P8103 CdS photocell has a minimum of 0.5MΩ dark resistance, packaged in a two leaded plastic-coated ceramic header.

Advanced Photonix's CdS Photocells are photodiode cells for visible light measurement designed to sense light from 400 to 700 nm. Their resistance decreases as the light level increases with efficiency characteristics similar to the human eye. These Light Dependent Resistors (LDR) are available in a wide range of resistance values. They are available in a two-leaded plastic-coated ceramic header or hermetically sealed TO metal cans.

Applications

- Industrial
- Audio Compressors
- Night Lights
- Photography Light Meters
- Solar Street Lights
- Flame Detection

Features

- Passive Resistance output
- Ceramic Package
- Available in Hermetically Sealed package
- Available in a wide range of resistance values



Figura 29: Folha de rosto: PDV-P8103

Customer Information Sheet

DRAWING No.: M20-782XXXX	SHEET 2 OF 2	IF IN DOUBT - ASK	(C)	NOT TO SCALE	THIRD ANGLE PROJECTION	ALL DIMENSIONS IN mm												
			<p>NOTES:</p> <ol style="list-style-type: none"> RECOMMENDED PCB HOLE SIZE = Ø1.00mm. <p>SPECIFICATION:</p> <p>MATERIAL: MOULDING = PA9T UL94V-0, BLACK CONTACTS = PHOSPHOR BRONZE FINISH (OVER NICKEL): 42 = GOLD FLASH ON CONTACT AREA, 100% TIN ON TAILS 46 = 100% TIN</p> <p>ELECTRICAL: CURRENT RATING = 3A VOLTAGE PROOF = 1000V AC CONTACT RESISTANCE = 20mΩ MAX INSULATION RESISTANCE = 1,000MΩ MIN</p> <p>ENVIRONMENTAL: TEMPERATURE RANGE = -40°C TO +105°C</p> <p>MECHANICAL: INSERTION FORCE = 1.96N MAX WITHDRAWAL FORCE = 0.29N MIN DURABILITY = 300 OPERATIONS</p> <p>PACKING: TUBE</p> <p>FOR COMPLETE SPECIFICATION SEE COMPONENT SPECIFICATION C001XX (LATEST ISSUE)</p>															
<p>ORDER CODE: M20-782XXXX</p> <p>No. OF CONTACTS: 02 TO 20, 25, 32, 36</p> <p>FINISH: 42 = SELECTIVE GOLD / 100% TIN 46 = 100% TIN</p>			<table border="1"> <tr> <td>WJP 10 01.08.17 20398</td> </tr> <tr> <td>NAME ISS. DATE C/NOTE</td> </tr> <tr> <td>APPROVED: W. J. PRESTON</td> </tr> <tr> <td>CHECKED: M. PLESTED</td> </tr> <tr> <td>DRAWN: J. EVANS</td> </tr> <tr> <td>CUSTOMER REF.:</td> </tr> <tr> <td colspan="2">ASSEMBLY DRG:</td> </tr> <tr> <td colspan="2">M20-782XXXX</td> </tr> <tr> <td colspan="2">SHT 2 OF 2</td> </tr> </table>				WJP 10 01.08.17 20398	NAME ISS. DATE C/NOTE	APPROVED: W. J. PRESTON	CHECKED: M. PLESTED	DRAWN: J. EVANS	CUSTOMER REF.:	ASSEMBLY DRG:		M20-782XXXX		SHT 2 OF 2	
WJP 10 01.08.17 20398																		
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CUSTOMER REF.:																		
ASSEMBLY DRG:																		
M20-782XXXX																		
SHT 2 OF 2																		
HARWIN www.harwin.com technical@harwin.com		TOLERANCES $X_{\pm} \pm 1\text{mm}$ $X_{\pm} \pm 0.50\text{mm}$ $X_{\pm} \pm 0.10\text{mm}$ $X_{\pm} \pm 0.01\text{mm}$		MATERIAL: SEE ABOVE		TITLE: 2.54mm PITCH SIL VERTICAL PC TAIL SOCKET ASSEMBLY												
		FINISH: SEE ABOVE S/AREA: mm ²				DRAWING NUMBER: M20-782XXXX												

Figura 30: Folha de rosto: barra de pinos

Pulse Proof Thick Film Chip Resistors



FEATURES

- High pulse performance, up to 10 kW
- High pulse voltage up to 4 kV, 1.2 μ s / 50 μ s
- Stability at different environmental conditions $\Delta R/R \leq 1\% (1000\text{ h rated power at }70^\circ\text{C})$
- AEC-Q200 qualified
- Material categorization: for definitions of compliance please see www.vishay.com/doc?299812



RoHS
COMPLIANT
HALOGEN
FREE

LINKS TO ADDITIONAL RESOURCES



3D Models

The pulse proof thick film chip resistor series is the perfect choice for high pulse load performance resistors. Typical applications include automotive DC-DC converters and on-board chargers, lighting ballasts, and storage drivers.

APPLICATIONS

- DC-DC converters
- On-board chargers
- Lighting ballasts
- Storage drivers

TECHNICAL SPECIFICATIONS

DESCRIPTION	D10/CRCW0402-IFD11/CRCW0603-IFD12/CRCW0805-IFD25/CRCW1206-IFCRCW1210-IFCRCW2010-IFCRCW2512-IF e3	e3	e3	e3	e3	e3	e3
Imperial size	0402	0603	0805	1206	1210	2010	2512
Metric size code	RR1005M	RR1608M	RR2012M	RR3216M	RR3225M	RR5025M	RR6332M
Resistance range	1 Ω to 100 k Ω						
Resistance tolerance	$\pm 10\%$; $\pm 5\%$						
Temperature coefficient	$\pm 200\text{ ppm/K}$						
Rated dissipation, P_{70} ⁽¹⁾	0.063 W	0.10 W	0.125 W	0.25 W	0.50 W	0.75 W	1.0 W
Operating voltage, U_{max} AC _{RMS} /DC	50 V	75 V	150 V	200 V	200 V	400 V	500 V
Permissible film temperature, θ_f^{max} ⁽¹⁾	155 °C						
Operating temperature range	-55 °C to +155 °C						
Max. resistance change at P_{70} for resistance range, $ \Delta R/R $ after:							
1000 h	$\leq 1.0\%$						
8000 h	$\leq 2.0\%$						
Permissible voltage against ambient (insulation):							
1 min, U_{ins}	75 V	100 V	200 V	300 V	300 V	300 V	300 V
Failure rate: FIT _{observed}	$\leq 0.1 \times 10^{-9}/h$						

Note

⁽¹⁾ Please refer to "Application Information" below

Revision: 07-Nov-2023

1

Document Number: 20024

For technical questions, contact: thickfilmchip@vishay.com

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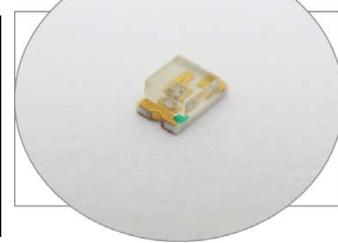
Figura 31: Folha de rosto: resistores

SURFACE MOUNT LED ORANGE, 0805 PACKAGE

BIVAR

SM0805UOC

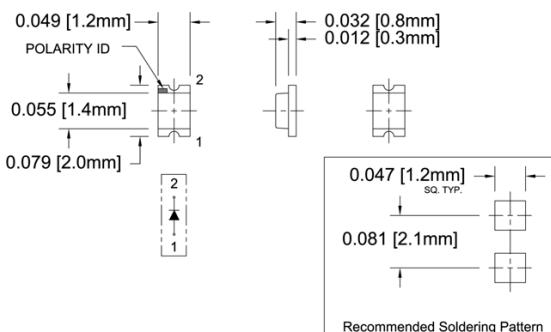
- ◆ Industry Standard 0805 Package
- ◆ RoHS Compliant
- ◆ Small Package and Footprint
- ◆ Water Clear Lens
- ◆ Wide Viewing Angle
- ◆ Ideal for Status Indication, Display, and Backlighting



Bivar Surface Mount 0805 package LED may be used in nearly any lighting or indication application. The miniature package is ideal for small scale applications such as general indication and backlighting. Low power consumption and excellent long life reliability are suitable for battery powered equipment. Bivar offers water clear LED lens for maximum luminous intensity. Wide variety of wavelength and intensity combinations are available to meet any illumination need. The SM0805 LED is packaged in standard tape and reels for pick and place assemblies.

Part Number	Material	Emitted Color	Peak Wavelength $\lambda_p(\text{nm})$ TYP.	Lens Appearance	Luminous Intensity (mcd) TYP.	Viewing Angle
SM0805UOC	AlGaInP	ORANGE	630	Water Clear	80	130°

Outline Dimensions



Outline Drawings Notes:
 1. All dimensions are in inches [millimeters].
 2. Standard tolerance: $\pm 0.010''$ unless otherwise noted.



Bivar reserves the right to make changes at any time without notice.

Bivar, Inc. — 4 Thomas, Irvine, California 92618, U.S.A.
 Phone: (949) 951-8808 Fax: (949) 951-3974 E-mail: bivar@bivar.com Web: www.bivar.com

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Figura 32: Folha de rosto: SM0805UOC



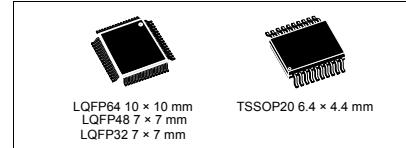
STM32F030x4 STM32F030x6 STM32F030x8 STM32F030xC

Value-line Arm®-based 32-bit MCU with up to 256 KB Flash, timers,
ADC, communication interfaces, 2.4-3.6 V operation

Datasheet - production data

Features

- Core: Arm® 32-bit Cortex®-M0 CPU, frequency up to 48 MHz
- Memories
 - 16 to 256 Kbytes of Flash memory
 - 4 to 32 Kbytes of SRAM with HW parity
- CRC calculation unit
- Reset and power management
 - Digital & I/Os supply: $V_{DD} = 2.4 \text{ V to } 3.6 \text{ V}$
 - Analog supply: $V_{DDA} = V_{DD}$ to 3.6 V
 - Power-on/Power down reset (POR/PDR)
 - Low power modes: Sleep, Stop, Standby
- Clock management
 - 4 to 32 MHz crystal oscillator
 - 32 kHz oscillator for RTC with calibration
 - Internal 8 MHz RC with x6 PLL option
 - Internal 40 kHz RC oscillator
- Up to 55 fast I/Os
 - All mappable on external interrupt vectors
 - Up to 55 I/Os with 5V tolerant capability
- 5-channel DMA controller
- One 12-bit, 1.0 μs ADC (up to 16 channels)
 - Conversion range: 0 to 3.6 V
 - Separate analog supply: 2.4 V to 3.6 V
- Calendar RTC with alarm and periodic wakeup from Stop/Standby
- 11 timers
 - One 16-bit advanced-control timer for six-channel PWM output
 - Up to seven 16-bit timers, with up to four IC/OC, OCN, usable for IR control decoding
 - Independent and system watchdog timers
 - SysTick timer



- Communication interfaces
 - Up to two I²C interfaces
 - Fast Mode Plus (1 Mbit/s) support on one or two I/Fs, with 20 mA current sink
 - SMBus/PMBus support (on single I/F)
 - Up to six USARTs supporting master synchronous SPI and modem control; one with auto baud rate detection
 - Up to two SPIs (18 Mbit/s) with 4 to 16 programmable bit frames
- Serial wire debug (SWD)
- All packages ECOPACK®2

Table 1. Device summary

Reference	Part number
STM32F030x4	STM32F030F4
STM32F030x6	STM32F030C6, STM32F030K6
STM32F030x8	STM32F030C8, STM32F030R8
STM32F030xC	STM32F030CC, STM32F030RC

November 2021

DS9773 Rev 5

1/93

This is information on a product in full production.

www.st.com

Figura 33: Folha de rosto: STM32F030K6T6TR

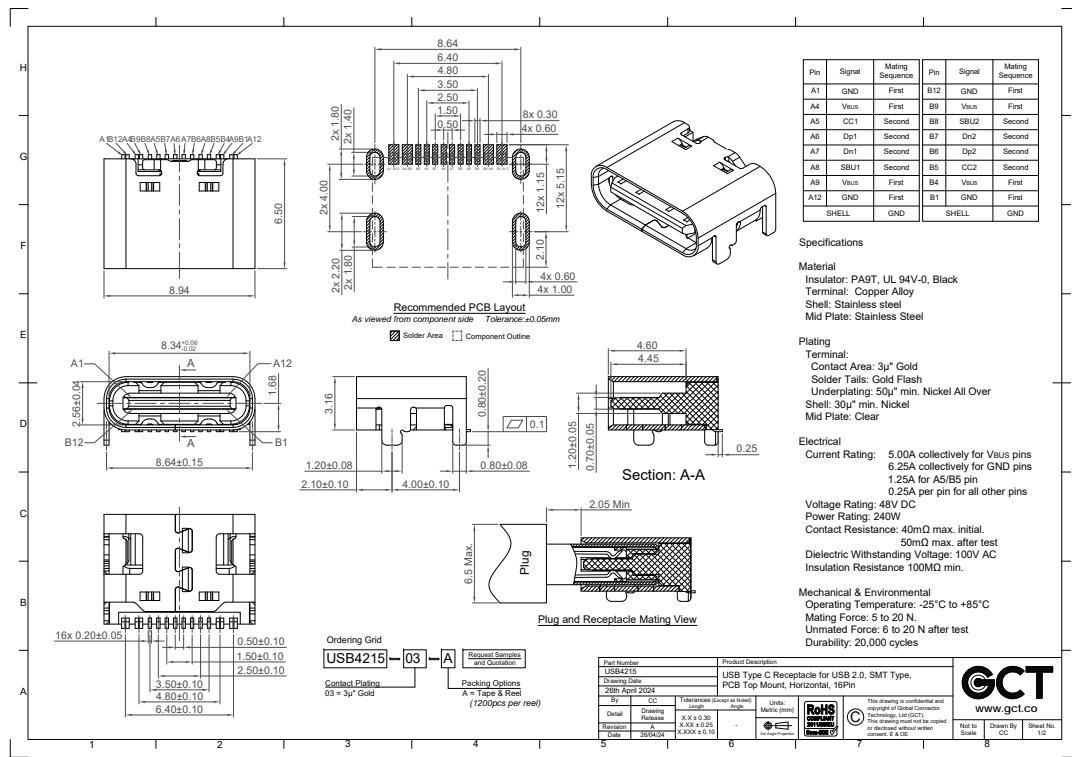


Figura 34: Folha de rosto: USB4215-03-A.REVA

5.2 Documentos auxiliares

 life.augmented

AN4325
Application note

Getting started with STM32F030xx and STM32F070xx series
hardware development

Introduction

This application note is intended for system designers who require a hardware implementation overview of the development board features such as the power supply, the clock management, the reset control, the boot mode settings and the debug management. It shows how to use the STM32F0x0xx products family and describes the minimum hardware resources required to develop an application.

This document includes detailed reference design schematics and the description of the main components, interfaces and modes.

Table 1. Applicable products

Type	Part number
Microcontrollers	STM32F030F4, STM32F030CC, STM32F030RC, STM32F030C6, STM32F030K6, STM32F030C8, STM32F030R8, STM32F070C6, STM32F070CB, STM32F070F6, STM32F070RB.

Note: In this document, the notation used for STM32F030xx devices is STM32F030 and the notation used for STM32F070xx devices is STM32F070. When referring to both series the notation STM32F0x0 is used. The pin count and memory size do not impact this hardware description.

Figura 35: AN4325 - Getting started with STM32F030xx and STM32F070xx series hardware development

LCD MOODULE SPECIFICATION FOR APPROVAL	DATE	18/03/04
	VER.	1.0
JHD162A	PAGE	1

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Figura 36: Folha de rosto: JHD162A



MCP2200

MCP2200 Rev. A2 Errata

The MCP2200 device that you have received conforms functionally to the current MCP2200 Data Sheet (DS22228), except for the anomalies described in this document.

Silicon Errata Issues

Note: This document summarizes all silicon errata issues from all revisions of silicon, previous as well as current.

1. Module: MCP2200 Device USB Compliance

Revision A0 was not registered with the USB IF as a compliant device. Revision A1 is registered as a USB compliant device.

Work around

Use revision A1. Revision A0 parts were primarily samples. All devices manufactured after the second Work Week of 2010 are revision A1 and USB compliant.

To determine the year and working week correctly, look for the first four digits on the package markings, which are Year (YY) and Work Week (WW) codes. Anything after 1001NNN is USB compliant.

2. Module: MCP2200 Device UART

Revision A1 and earlier had a reduced sustained throughput at higher baud rates on the UART side of the bridge. When not using hardware flow control on the UART, data could be lost if attempting high data throughput when the UART baud rate is high.

Work around

Use revision A2. The revision number can be identified using [Table 1](#).

If using rev A1 or earlier: Enable the RTS and CTS pins to enable hardware handshaking. The throughput will be reduced, however, no data will be lost.

TABLE 1: REVISION NUMBER IDENTIFICATION

Silicon Revision	YYWWNNN		Condition
	Start Date	End Date	
Rev A0	—	1001NNN	
Rev A1	1002NNN	1051NNN	
Rev A2	1052NNN	—	In Production

Legend: "N" is any alphanumeric character.

Data Sheet Clarifications

None.

Figura 37: MCP2200 Errata